November 30, 2005

Psomas Engineering
c/o Mr. Matt Cassel
4179 Riverboat Road, Suite 200
Salt Lake City, UT 84123

Subject: Geotechnical/Geological Assessment of Slate Canyon Water Line Provo, Utah

Mr. Cassel,

IGES has completed a geotechnical/geological assessment of the Slate Canyon Water Line project. It is our understanding that the project will consist of removing the existing water line and designing and installing a replacement water line. The new line will generally follow the existing trail up the canyon and will extend from the Boardman Springs area down to the State Hospital located north of the canyon mouth. The purposes for this investigation included defining the soils and bedrock conditions along the proposed alignment of the water line and how these conditions may impact on the project's constructability.

Our scope of work included a site reconnaissance, soils/bedrock mapping of the area, a seismic refraction survey and preparation of this letter report.

GEOLOGIC CONDITIONS

GEOLOGIC SETTING

The site is located, at elevations between approximately 5,000 to 7,600 feet, up Slate Canyon within the western portion of the Wasatch Range in the southern portion of Utah Valley. The Wasatch Range is the easternmost expression of pronounced Basin and Range extension in north-central Utah. The Wasatch Range is bounded to the west by the Wasatch Fault and Utah Valley, a sediment-filled structural basin of Cenozoic age (Hintze, 1980). The Wasatch Range consists of folded and faulted rocks ranging from Precambrian to Mississippian bedrock.

STRATIGRAPHY

Exposed bedrock at the project site is mapped as upper Precambrian quartzite and tillite to Mississippian limestone (Baker, 1973). A Site Geologic Map of the project area is included with this report (Plate 2).

Mississippian

Great Blue Limestone (Mgb)

The Great Blue Limestone consists of dark gray to black, thin bedded and shaley limestone with some interbedded black and brown shale. Scattered thin beds of rusty-weathering, fine-grained, dark gray quartzite are encountered in the lower portion. The thickness in Slate Canyon ranges up to 2,700 feet (Baker, 1973).

Humbug Formation (Mh)

The Humbug Formation consists of light to dark gray, thin to thick bedded limestone with some dolomite. It also contains abundant chert and is interbedded with medium to fine-grained, light gray to buff, limy to quartzitic sandstone which causes a characteristic buff and gray banding of outcrops. The thickness is up to 520 feet along the southern portion of the Wasatch Range (Baker, 1973).

Deseret Limestone(Md)

The Deseret Limestone consists of interbedded limestone and dolomite in thick beds with distinctive light and dark gray banding in outcrops. Black chert in thin layers, blebs, and irregular masses is present in most beds and very abundant in some. The thickness is up to 575 feet in Slate Canyon (Baker, 1973).

Gardison Limestone (Mg)

The Gardison Limestone is a dark gray, mostly thin bedded limestone with abundant light brown to black chert nodules. It is a cliff forming unit with thicknesses up to 900 feet in the southern portion of the Wasatch Range (Baker, 1973).

Fitchville Formation (Mf)

The Fitchville Formation consists of medium to light gray, thin bedded to massive, cliff forming dolomite. No chert is present, but small vugs are numerous. There are some interbedded limestone beds in the upper part. A basal bed consists of buff to gray, coarse sandstone. The thickness of the formation ranges between 100 to 265 feet in the southern portion of the Wasatch Range (Baker, 1973).

Cambrian

Maxfield Limestone (Єm)

The Maxfield Limestone consists of light to dark gray, mainly thin bedded limestone with abundant yellow-brown to grayish-yellow mottling with interbedded gray to white dolomite and oolitic limestone. Thickness varies beneath the overlying unconformity, but ranges between 350 and 500 feet along the southern Wasatch Range.

Ophir Formation (Єo)

The Ophir Formation consists of olive-green micaceous shale with some thin beds of greenish sandstone and a zone with thin beds of yellow to brown mottled shaley limestone in upper parts. Thickness ranges between 100 and 250 feet along the southern Wasatch Range.

Tintic Quartzite (Єt)

The Tintic Quartzite consists of light brown weathered, white to tan, fine to coarse grained, thin to thick bedded quartzite with a few conglomeratic bands in the lower 200 feet that contain quartz pebbles as much as 2 inches in diameter and with quartz boulders 12 inches and greater in diameter located at the base of the formation. Greenish quartzite with interbedded greenish shale is encountered at a gradational contact with overlying Ophir Formation. The thickness of the Tintic Quartzite in Slate Canyon is 1,170 feet (Baker, 1973).

Precambrian

Mineral Fork Tillite (pЄmf)

Gray to brown, fine to coarse grained micaceous siltsone weathering dark brown to black with scattered boulders as much as 1 foot in diameter of dolomite, quartzite, and greenstone. Tillite wedges exposed in Slate Canyon. Thicker sections of the Mineral Fork Tillite are encountered in Rock Canyon located to the north (Baker, 1973).

Big Cottonwood Formation (pЄbc)

Quartzite thin to thick bedded, subrounded coarse-grained to conglomeratic; purple to maroon, brown and pinkish gray with interbedded gray and green micaceous quartzite and phyllite, and purple to maroon slate. Upper exposed thicknesses are reported to be 1,347 feet within the canyon (Baker, 1973).

FIELD INVESTIGATION

Slate Canyon is a relatively large canyon having a total drainage area of approximately 3,800 acres (~6 sq-miles). IGES completed a site reconnaissance of the Slate Canyon drainage basin and main channel on October 13, 2005 and the seismic survey was completed on November 2, 2005. IGES observed the slopes of the drainage basin and reviewed surficial geologic mapping of the basin (Hintze, 1978). The approximate boundaries and locations of the drainage basin sub-areas are shown on Plate 3.

Prior to this assessment, several trenches were excavated as part of two previous surface fault rupture hazard assessments within the proposed 22-acre Aspen Summit Development (IGES, July 2004; IGES, 2003). In general the soils exposed in most trenches were comprised of Bonneville aged sediment. The Bonneville aged sediment was comprised of clast-supported fine to medium-grained gravel and matrix-supported gravels. These layers varied in thickness but were generally less than 1-foot thick up to 2- to 3-feet thick and were interfingering to continuous. These trenches are located within part of the old Slate Canyon channel area. This channel area was isolated from the current channel to the north during prior channel modifications. The debris-flow deposits appear to be located along the general area of the old channel alignment. These debris-flow deposits consist of matrix supported gravel, cobbles, and boulders. The matrix consists of sandy silt; fine- to coarse-grained gravel, fine- to coarse-cobbles, and occasional boulders up to 4 to 5 feet in diameter were observed.

Slate Canyon soils and bedrock were mapped previously by IGES personnel associated with a separate investigation of the canyon (IGES December, 2004). This previous work was completed as a part of a debris flow assessment and more specific mapping attention was given to the slopes that comprise the canyon walls than along the trail system. Since the trail is generally located south of the drainage channel, only the north facing slope descriptions have been included in this report. We present the information as an aid in understanding the nature of soils/bedrock in the canyon. The location of the sub-areas is illustrated on Plate 3.

Sub-area A – North Facing Slope

The soil cover has a high percentage of loose gravel/talus. Some relatively mature vegetation was observed in the lower elevations near the main channel. Some boulders were observed on slopes at lower elevations, the main channel appears to have cobbles and boulders lining the bottom. The main channel banks are comprised of dark brown topsoil with occasional gravel, cobbles and boulders. The majority of the bedrock in this sub-area is mapped as Tintic Quartzite (Єt), Mineral Fork Tillite (pЄmf) which is gravel- to boulder-sized clasts of dolomite and quartzite in a fine mud matrix with some interbedded layers of slate, and Big Cottonwood Formation quartzite (pЄbc) which is red, purple, and tan quartzite, gritstone, and quartz pebble conglomerate with some purple and green slate. Portions of this sub-area are mapped as the Ophir Formation (Єo) that is comprised of phyllitic shale with some interbedded limestone and quartzite (Hintze, 1978).

Sub-area C – North Facing Slope

In general, the bottom of the main channel is lined with gravel, cobbles and boulders; bedrock outcrops were not observed. The main channel banks are mostly soil with moderate vegetation, and some mature vegetation. The soil in narrow valleys and low areas appears to be thicker, potentially on the order of 10 to 20 feet or more. A few small landslides were also observed in the main channel in this area. The largest of these slides was estimated to be 80 to100 feet long, 20 to 30 feet wide and 5 to 6 feet deep. A water pipe was observed on the slope, at approximately 6,000 feet elevation running perpendicular to the slope. The majority of the bedrock in this sub-area is mapped as

Tintic Quartzite (Єt), Mineral Fork Tillite (pЄmf) which is gravel- to boulder-sized clasts of dolomite and quartzite in a fine mud matrix with some interbedded layers of slate, and Big Cottonwood Formation quartzite (pЄbc) which is red, purple, and tan quartzite, gritstone, and quartz pebble conglomerate with some purple and green slate. Portions of this sub-area are mapped as the Ophir Formation (Єo) that is comprised of phyllitic shale with some interbedded limestone and quartzite. Portions of this sub-area are also mapped as colluvium (Qco), which is described as angular debris on hill slopes and includes talus. A high elevation area is mapped as landslide, avalanche, slump, and mudflow deposits (Qls) which is described as unsorted angular debris with large limestone blocks abundant (Hintze, 1978).

Sub-area F – North Facing Slope
The bottom of the main channel is lined with gravel, cobbles, and occasional boulders up to 4 to 5 feet in diameter. The banks of the main channel are approximately 7 to 12 feet deep and comprised of dark brown topsoil with some gravel and cobbles and scarce boulders in the banks. Bedrock in this sub-area is mapped as Tintic Quartzite (Єt) and the Big Cottonwood Formation quartzite (pЄbc) which is red, purple, and tan quartzite, gritstone, and quartz pebble conglomerate with some purple and green slate (Hintze, 1978).

Sub-area H – North Facing Slope
The bottom of the main channel is lined with gravel, cobbles, and boulders up to 4 to 5 feet in diameter. The banks of the main channel are mostly soil with some gravel, cobbles, and scarce boulders. Bedrock in this sub-area is mapped as Maxfield Limestone (Єm) which is described as limestone and dolomite, and Fitch Dolomite (DMf) which is described as unfossiliferous dolomite with some sandstone, Gardison Limestone (Mg) which is described as bedded limestone (Hintze, 1978).

Sub-area I – North Facing Slope
In general, soil was only observed in valleys, and was very thick. The soil cover over the bedrock thickens with lower elevations. Isolated areas of scrub oak were observed at lower elevations. The north drainage bank is, in areas, comprised of highly fractured bedrock. The south side of the drainage bank is comprised of soil with frequent gravel, cobbles, and some boulders. Dense scrub oak was observed on the south side of the drainage. The bottom of the main channel is lined with cobbles and boulders. A channel that runs south to north was observed on the west side of Sub-area I that appears to have bedrock outcropping on both sides. Gardison Limestone (Mg) which is described as bedded limestone and Deseret Limestone (Md) which is described as thin to thick bedded limestone and dolomite are bedrock units mapped in this sub-area (Hintze, 1978).

Sub-area K – North Facing Slope
The bottom of the main channel is lined with gravel, cobbles and some boulders. Baker has mapped the majority of this sub-area as consisting of the Humbug Formation (Mh) which is described as sandstone interbedded with limestone and dolomite and the Great Blue Limestone (Mgb) which is described as limestone with some interbedded shale (Baker, 1973).

CROSS-SECTION DESCRIPTIONS

The following descriptions were associated with our previous investigation of the channel. Although the information was gathered specifically for a debris flow assessment, some indication of the soils and bedrock in the area near the trail can be surmised from the descriptions. All cross section locations are illustrated on Plate 3.

Cross-Section CS-1
This cross section is located north of the Slate Canyon Forest Service entrance gate and between Sub-areas A and B. Above the north bank, the canyon wall is comprised of a talus slope derived from exposed bedrock 200 feet above the channel. The banks of the main channel are comprised of sediment with no bedrock outcropping at the surface. The bottom of the main channel is lined with gravel, cobbles and boulders up to 4 feet in diameter. Sand- to clay-sized particles make up approximately 15 to 20% of the soil composition in the bottom of the channel. There is a small natural boulder dam approximately 3 feet high located upstream from CS-1.

Cross-Section CS-4
The material on the channel bottom is comprised of gravel, cobbles and boulders. There are many boulder piles. Moderate to dense vegetation was observed in the main channel. Dense vegetation was observed downstream.

Cross-Section CS-5
The material on the channel bottom is gravel, cobbles and boulders. A sediment bar that is approximately 3 feet high and 30 feet long runs along the channel side. Dense vegetation with mature trees was observed in and near the main channel.

Cross Section CS-6
The material on the channel bottom is mostly cobbles and boulders up to 4 feet in diameter. Moderate vegetation was observed in the channel bottom with dense vegetation on the banks. The south slope best represents the general channel profile at this location. Dark brown topsoil comprises the majority of the main channel banks with occasional gravel and cobbles.

Several hundred feet downstream from CS-6, there are large bedrock exposures on the north banks of the main channel; these exposures extend into the channel bottom. Sediment, organic debris, and large logs were observed in the channel bottom. Bedrock spans approximately 600 feet. The south banks of the main channel are densely vegetated; the north bank is lightly vegetated.

Cross-Section CS-7
The material observed on the channel bottom consists of gravel and cobbles with some boulders. The banks of the main channel are comprised of dark brown topsoil with occasional gravel and cobbles; bedrock is not exposed near this cross-section.

Approximately 400 feet downstream from CS-7 bedrock was observed to outcrop in the main channel for approximately 200 feet linearly. The south bank of the main channel is approximately 30 feet high; the north bank continues up and transitions into the canyon wall.

Cross-Section CS-8
The banks of the main channel are approximately 8 to 12 feet high and slope approximately 30 to 60 degrees. The width at the channel bottom is 5 to 12 feet. The material on the channel bottom is gravel, cobbles and boulders with few fines. Dense vegetation was observed in the main channel. The banks of the main channel are comprised mostly of dark brown topsoil with occasional gravel and cobbles. Sediment bars approximately 1 to 3 feet high were observed in the main channel.

Cross-Section CS-9
The material on the channel bottom consists of gravel, cobbles and boulders with sand and silt. Moderate vegetation was observed in the main channel. The north bank is 90% bedrock and lightly vegetated, the south bank is comprised of dark brown topsoil with occasional gravel and cobbles.

Cross-Section CS-10
Talus slopes were observed on both sides of the main channel with bedrock exposures on the eastern portion. The material on the channel bottom is gravel, cobbles and boulders up to 4 feet in diameter. In general the banks are comprised of dark brown topsoil with occasional gravel and cobbles.

GEOPHYSICAL INVESTIGATION

As a part of this investigation, 6 seismic refraction survey lines were completed along the alignment. The survey lines were generally placed parallel to the trail alignment and were located in areas that represented various soil/bedrock types. The refraction survey lines completed for this project were constrained in length by the meandering nature of the trail. Very few locations existed where the lines could extend the full cable spread length of 200 feet. The geophysical lines completed for this survey ranged from 55 to 140 feet in total length. The approximate location of the geophysical lines is illustrated on Plate 2, the Site Geologic Map.

The surveys completed for this investigation consisted of obtaining shear wave velocities. A sledge hammer that was used to strike a steel plate on the ground served as the energy source for the seismic lines, a signal enhancement seismograph was used to record readings from the geophones. The survey lines consisted of 12 geophones spaced at various intervals based on the total length of the line. Plates 4 through 9 illustrate the results of the seismic survey. The elevations illustrated on the plates are relative and do not correspond to actual site elevations. Average distinct shear velocities were encountered in the survey cross sections as illustrated on the plates. The upper purple layer in each of the plates represents the approximate soil thickness at the survey locations. The lower red layer represents bedrock.

Results of the surveys indicate that the soil thickness along the alignment ranges from a depth of 5 feet to a depth of nearly 18 feet. The average shear wave velocity for the soils ranges from a low of 532 ft/sec to a high of 1,038 ft/sec. The average shear wave velocity for the bedrock ranges from a high of 2,138 ft/sec associated with the Deseret Limestone to a high of 7,311 ft/sec in the Tintic Quartzite.

The seismic velocities presented in this report represent the average velocities between the geophone intervals. Sections of higher and lower seismic velocities may occur between each geophone interval.

GEOLOGIC HAZARDS

Landslides/Debris Flows

Several mapped landslides are known to exist within Slate Canyon. A rock/debris flow was encountered along the alignment during our field investigation and references to other minor slides are made in the soils/bedrock descriptions. The water line should be buried at a sufficient depth to mitigate potential impact from such events. Increases in depth should be made where evidence of uphill sliding are noted during the construction. An IGES representative should be on site during construction to identify areas that would require deepening of the waterline placement. It is intended that with the additional depth of burial the majority of future slides that occur will float over the waterline. However, deep seated failures could still impact on the water line, even with additional depth.

Flooding

Another potential concern is flooding of the main channel. When flood events occur, excess erosion may also occur on the stream banks causing instability on the channel walls. This instability and slope movement could impact on the water line if the soils supporting the water line are undermined. We recommend that the water line be generally located where possible on the south side of the trail system away from the channel to avoid potential impacts associated with channel flooding. Some channel armoring should be considered where the water line cannot be placed more than 30 feet south of the channel wall.

CONSTRUCTION CONSIDERATIONS

Excavations - We anticipate that the water line will generally be buried at depths of no greater than 5 feet below existing site grade. Based on the results of our seismic refraction surveys and our field mapping the majority of the water line alignment will be located in soil deposits. However, the soils in the area have frequent large cobbles and boulders that may be difficult to excavate with conventional construction equipment. The boulders and cobbles generally consist of float associated with the bedrock mapped in the area. As noted in our seismic surveys, the bedrock velocities range from a 2,138 to 7,311 ft/sec. The lower velocities are associated with the Deseret and Maxfield Limestone Formations. While the higher velocities are associated with the Great Blue Limestone and the Tintic Quartzite Formations.

The total average bedrock shear wave velocity is 4,908 ft/sec with a standard deviation of 2,216 ft/sec. Review of the 35^{th} Edition of the Caterpillar Performance manual indicates that bedrock with seismic velocities which are equal to the average are rippable to marginally rippable with a D8 dozer. Seismic velocities are generally higher than shear wave velocities indicating that a larger D9 dozer may be required to rip the higher velocity bedrock encountered in our investigation. If large bedrock float is encountered in the trenching, the material should generally be rippable with a D8 dozer.

Large construction equipment may not be allowed for use in the canyon. If such equipment is prohibited, the contractor should anticipate the use of specialized trenching saws or blasting of bedrock/float during the construction process.

Structural Fill

All fill placed as backfill in the trenches should consist of structural fill. The onsite soils are generally suitable for use as structural fill. On site material for use as structural fill should contain no particles greater than 6 inches in size, and should have a plasticity index of less than 10. Some limitations may be encountered during the construction process for the use of on site material. The material may be too coarse and not allow for appropriate compaction and the material may be too dry and excess water may be required to provide adequate compaction. An imported granular material may be required as structural fill in portions of the alignment.

Imported structural fill should be a relatively well graded granular soil with a maximum of 60 percent passing the No. 4 mesh sieve and a maximum fines content (percent passing the No. 200 mesh sieve) of 20%. The fines should have a liquid limit less than 25 and plasticity index less than 10. Structural fill should be free of vegetation and debris, and contain no inert materials larger than 3-inches in nominal size. All structural fill should be 1-inch minus material when within 1 foot of any installed piping.

Structural fill should be placed in maximum 8-inch loose lifts and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer. Soils in compacted fills should be compacted to at least 95% of the maximum dry density, as determined by ASTM D-1557. The moisture content should be within 2 percent of optimum for all structural fill at the time of compaction. Any fill materials obtained from off-site sources should be approved prior to importing. Also, prior to placing any fill, the excavations should be observed by the Geotechnical Engineer to confirm that unsuitable materials have been removed. In addition, proper grading should precede placement of fill, as described in the General Site Preparation and Grading subsection of this report.

REFERENCES

Baker, Arthur A., 1973, *Geologic Map of the Springville Quadrangle, Utah County, Utah* Depatment of the Interior United States Geological Survey

Caterpillar Corporation, 2004, *Caterpillar Performance Manual, Edition 35,*

Hintze, L.H., 1978, *Geologic Map of the Y Mountain Area, East of Provo*. Brigham Young University Geology Studies – Special Publication 5.

Intermountain GeoEnvironmental Services Inc., March 25, 2003. Surface Fault Rupture Assessment and Report for Aspen Summit Development 22 Acre Property, Approximately 800 South Slate Canyon Drive, Provo, Utah, IGES Job No. 00372-007.

Intermountain GeoEnvironmental Services Inc. July 26, 2004. Letter Response to Utah Geological Survey Review of Surface Fault Rupture Hazard Study and Report for Sunridge Hills 16 Acre Property, Provo Utah, IGES Job No. 00345-001.

Intermountain GeoEnvironmental Services Inc. December 8, 2004. Debris Flow Hazard Assessment Slate Canyon Watershed, Provo Utah, IGES Job No. 00637-001,

Slope Considerations

IGES was asked to consider the slopes near the mouth of the canyon as the waterline trends north to the State Hospital. The soils in this area will generally consist of debris flow material as encountered in the trenches excavated for the previous investigations. These soils generally consist of matrix supported gravel, cobbles, and boulders. The matrix consists of sandy silt; fine- to coarse-grained gravel, fine- to coarse-cobbles, and occasional boulders up to 4 to 5 feet diameter were observed. The slopes are relatively steep and if excavations are located near the base of these slopes raveling of the slope material will likely occur and could impact on the construction site. If the alignment cannot be moved away from these slopes then special shoring or slope stabilization may be required during construction.

Groundwater Considerations

We anticipate that groundwater may be present in several areas along the alignment, particularly in the meadow areas near Boardman Springs and at the confluence of minor side canyons with the main channel of Slate Canyon. Placing a pump in a low section of the excavation can complete temporary dewatering in these areas. Dewatering should also be completed during the backfilling process to maintain the soils in a compactable condition.

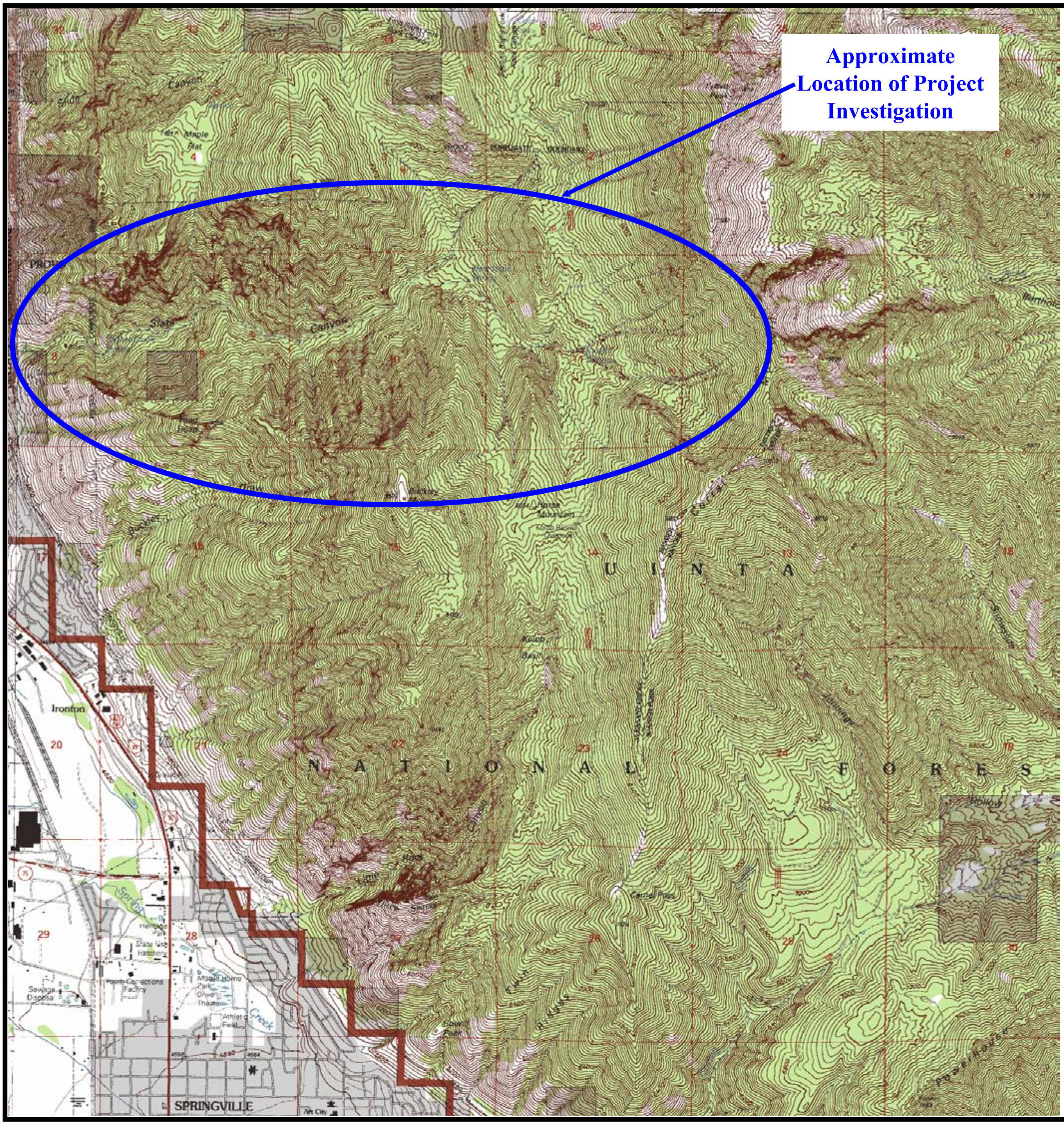
We appreciate the opportunity to be of service on this project, should you have any questions regarding this letter report please contact us at (801) 270-9400.

Regards,
IGES, Inc.

Hiram Alba, P.E., P.G.
Principal

Plates/Attachments

Plate 1	Site Vicinity Map
Plate 2	Site Geologic Map
Plate 3	Sub Basin Site Map
Plates 4 to 9	Seismic Refraction Lines



BASE MAP:
SPRINGVILLE, UTAH
U.S.G.S. 7.5 MINUTE QUADRANGLES

0' 2000' 4000'

SCALE 1:48,000

CONTOUR INTERVAL 40 feet

MAP LOCATION

N

IGES

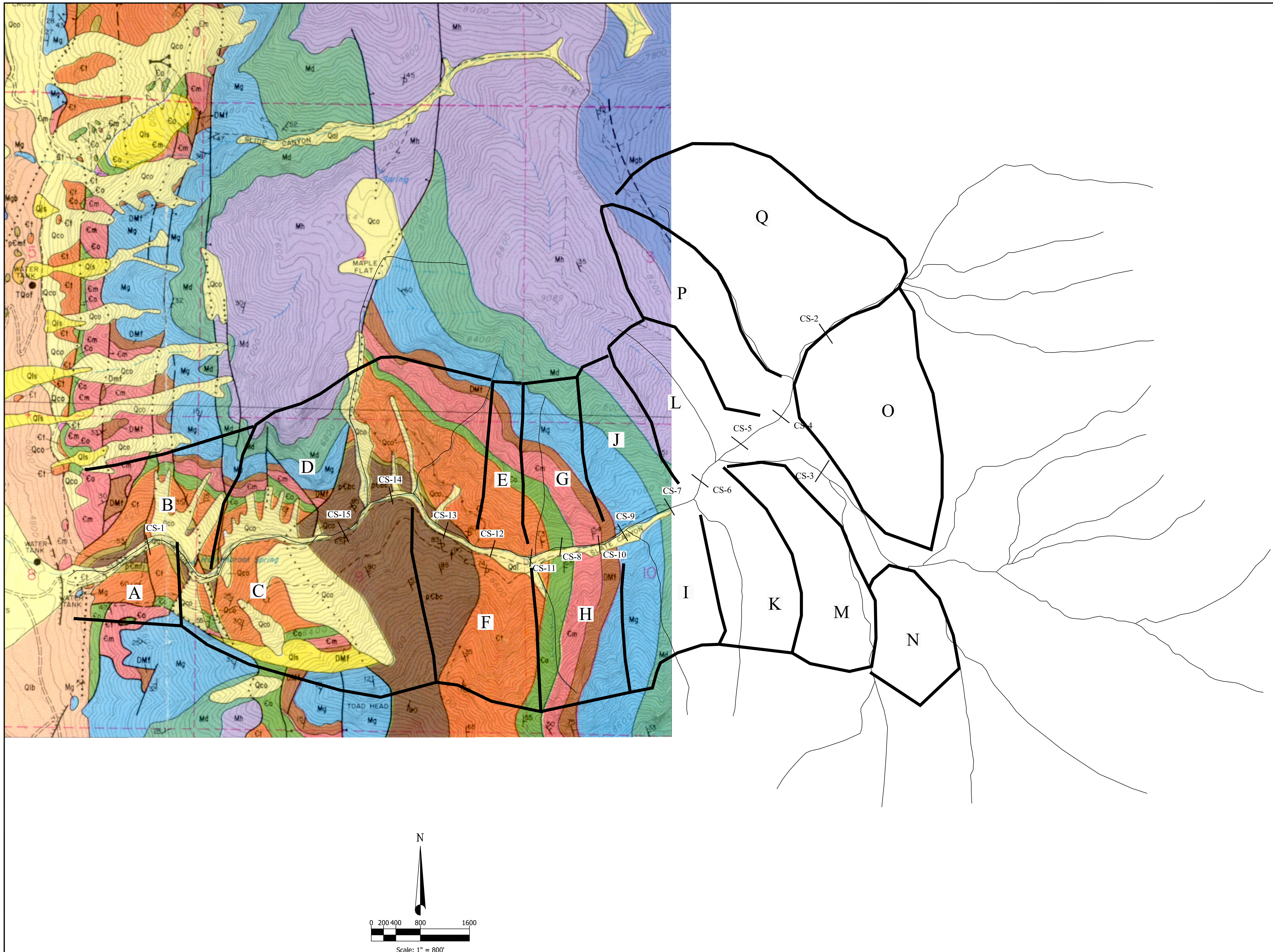
Project Number – 00323-010

Geotechnical Assessment
Proposed Pipeline
Slate Canyon
Provo, UT

SITE VICINITY MAP

Plate

1



Qal Qrf Qco	Qal-Stream valley alluvium - rounded, stream transported debris. Qrf - Recent alluvial fan deposits. Qco-Colluvium - angular debris on hill slopes, includes talus.
Qls	Landslide, avalanche, slump, and mudflow deposits - unsorted angular debris; large limestone blocks abundant. Deposits common at base of steep snow basins and races on west front of range.
Qlb	Lake Bonneville sediments undifferentiated includes deposits of Provo, Alpine, and Bonn age. Rounded gravel, sand, silt.
TQof	Pre-Bonneville fan and landslide deposits.
Mmc	**Manning Canyon Shale** Black to brown shale with some interbedde limestone and sandstone. Plant fossils. About 1650 feet thick.
Mgb	**Great Blue Limestone** Dark gray thin bedded limestone with muc interbedded shale in lower third of formation. 2800 feet thick.
Mh	**Humbug Formation** About 25% gray, brown or pink sandstor interbedded with fine-grained to calcarenitic linestone and dolomite. About 930 feet thick.
Md	**Deseret Limestone** Thin-to-thick bedded medium-to-dark gray encrinitic limestone and dolomite. Black and gray chert common in small nodules and banc About 850 feet thick.
Mg	**Gardison Limestone** Bedded limestone; abundant corals and brachiopods in lowest 50 feet. Top of formation marked by 70 feet of limestone with bla chert bands. Upper half of formation is inter bedded limestone and dolomite. Total thickness approximately 550 feet.
DMf	**Fitchville Dolomite** Light-to-medium gray, vuggy, unfossiliferou dolomite with 20 feet of dolomitic sandstone base. Totals 260 feet in thickness.
€m	**Maxfield Limestone** Basal two-thirds is motted dark to medium gray limestone; upper third is medium to very light gray banded dolomite. Trilobite fragmen common in a few beds in the lower part. Total about 600 feet in thickness.
€o	**Ophir Formation** Olive, phyllitic shale, with 30 feet of thin bedded shaly limestone 170-200 feet above b Lower 60 feet is greenish brown quartzite ar phyllite. About 250 feet thick.
€t	**Tintic Quartzite** Orange weathering, tan quartzite. From Slate Canyon southward the formation contain a diabase flow, up to 25 feet thick, 160 feet above the base of the formation. Quartzite below the diabase is generally white. Total thickness about 1080 feet.
p€mf	**Mineral Fork Tillite** Subangular boulders, cobbles, and pepples of dolomite and quartzite in an olive brown fine mud matrix. Slightly schistose. Not present south of Slate Canyon. About 145 feet is maximum thickness.
p€bc	**Big Cottonwood Formation** Red, purple and tan quartzite, gritstone, and quartz pepple conglomerate with 20% in beds of purple and green slate. About 1100 feet exposed in Slate Canyon. Base concealed.

PLOT DATE: 11/30/05

MARK		DATE	BY	CHK	MARK		DATE	BY	CHK	MARK		DATE	BY	CHK
REVISIONS					REVISIONS					REVISIONS				

IGES
ideas for a changing world

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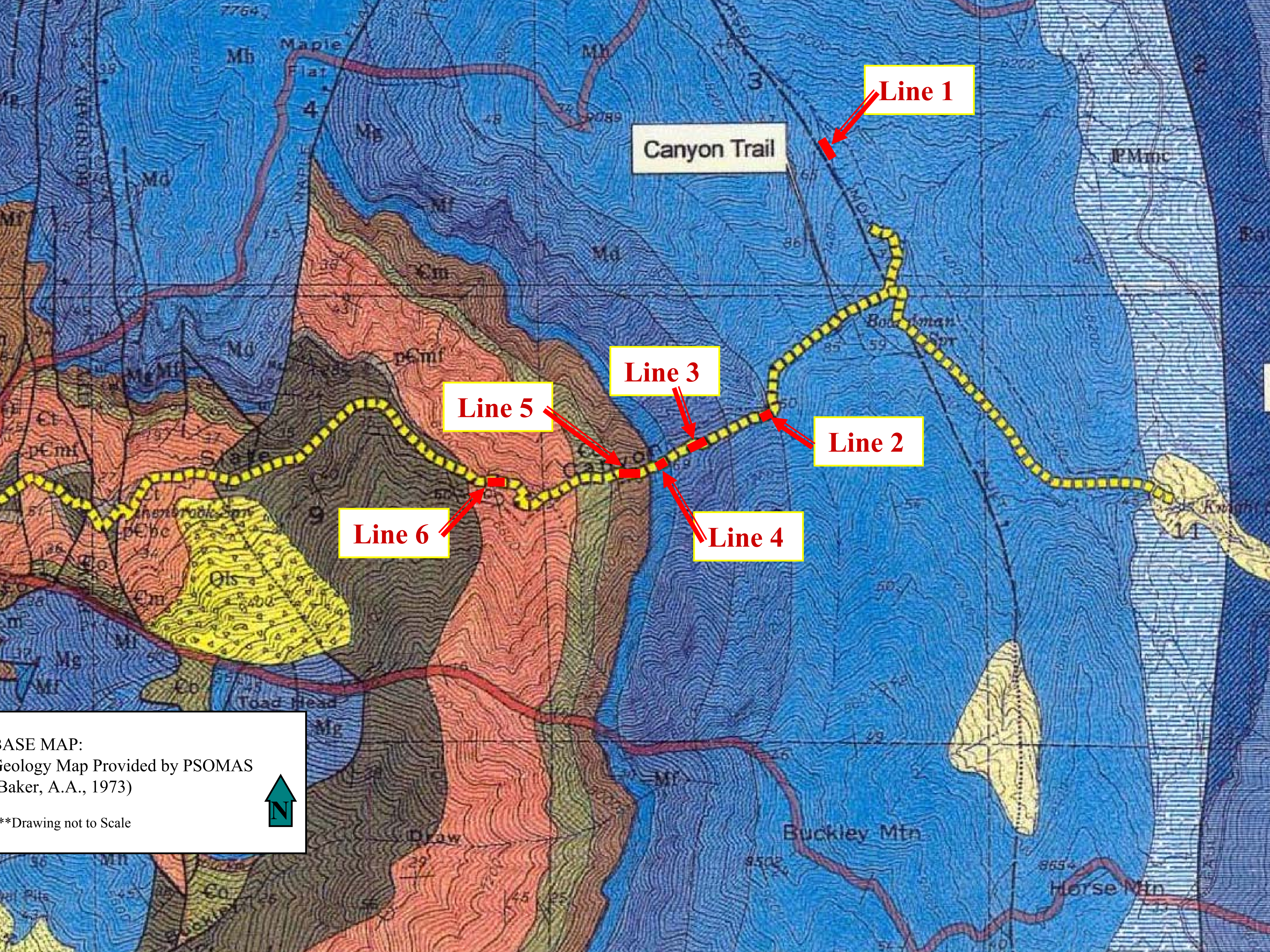
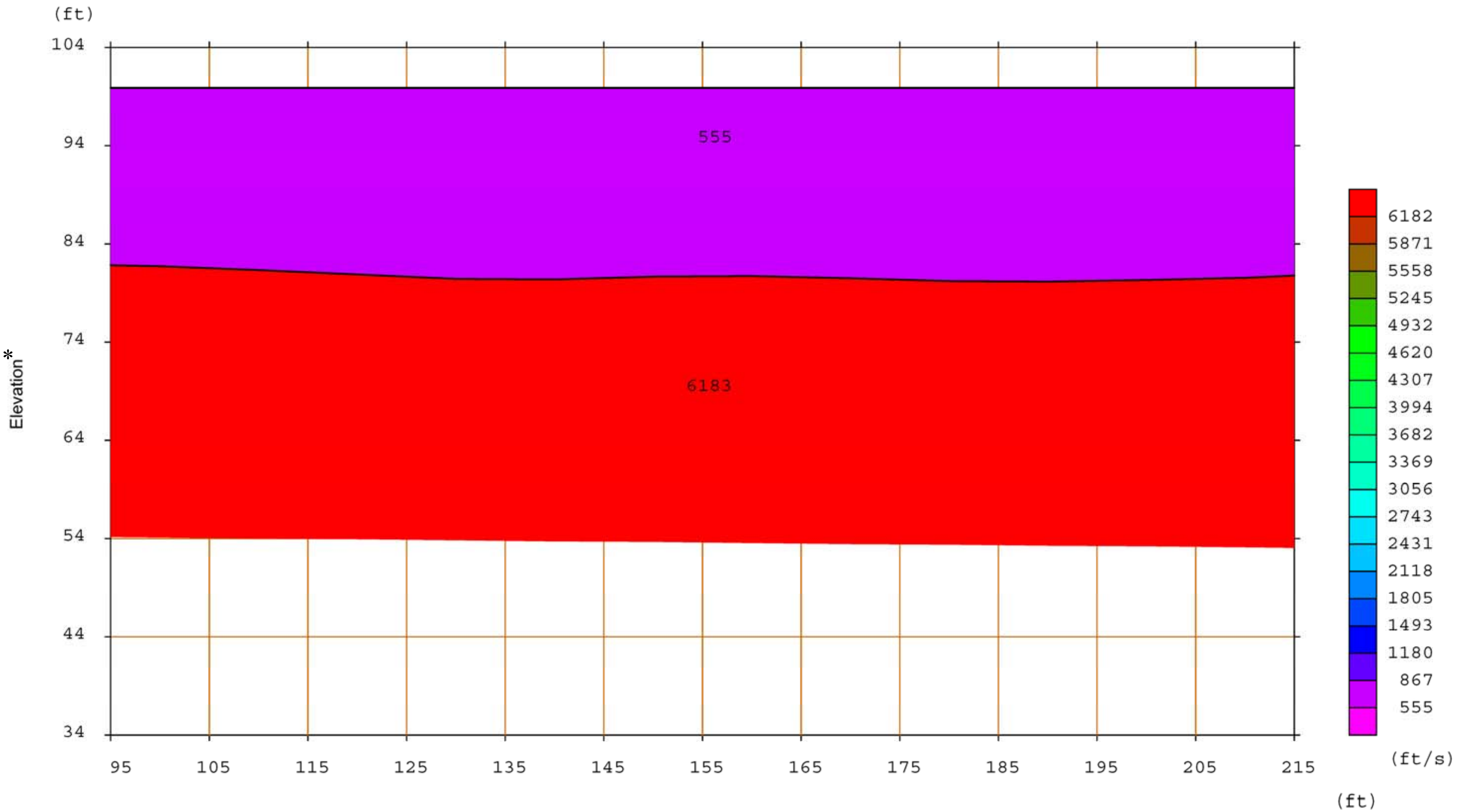
(801) 270-9401 Fax

SLATE CANYON
WATERLINE INVESTIGATION
PROVO, UT
SITE MAP

REF:	USGS QUAD SPRINGVILLE, UT	APPROVED BY: DATE:	-
DATE:	USDA, 1998	PLOT SCALE	1=1
CHECKED BY: DATE:	-	DWG SCALE	1"=800'
PROJECT:	00323-010	REVISION NO:	1
		PLATE	3


Line 1
Canyon Trail
Line 3
Line 5
Line 2
Line 6
Line 4
Buckley Mtn
Horse Mtn
BASE MAP:
Geology Map Provided by PSOMAS
(Baker, A.A., 1973)
**Drawing not to Scale
N



* Relative Elevation

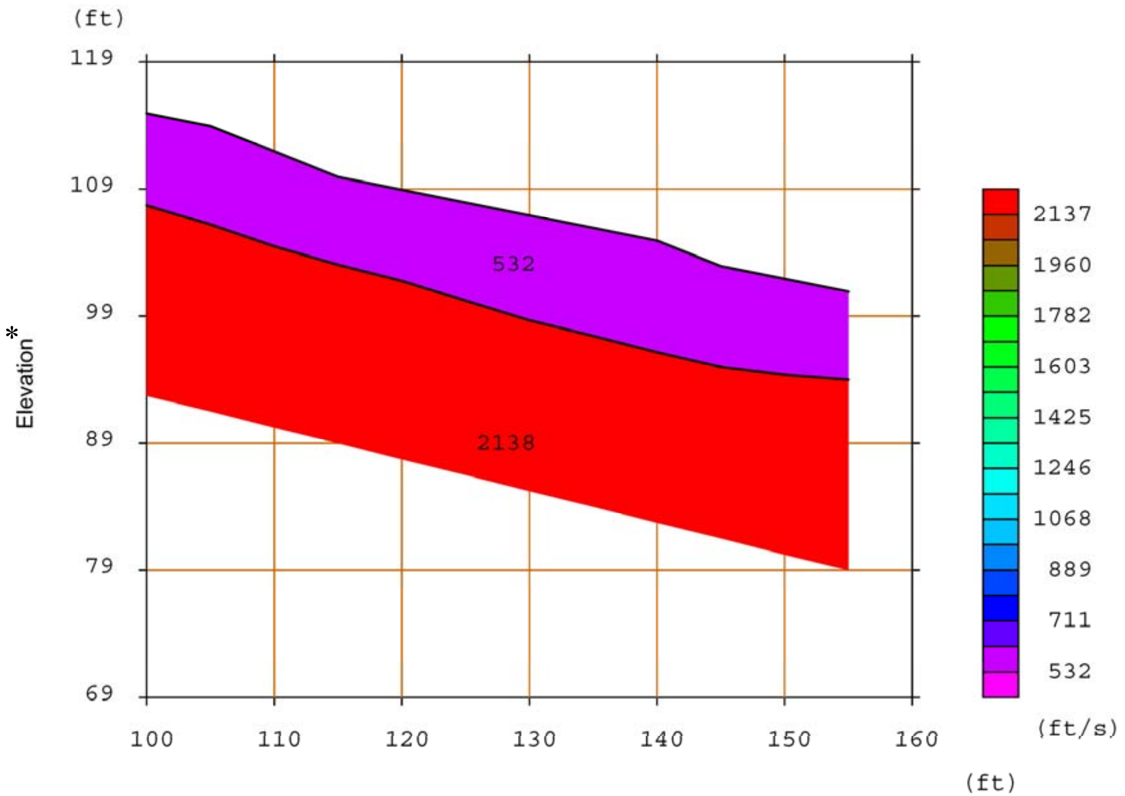
IGES

Line 1 – Great Blue Limestone

Geotechnical Assessment
Proposed Pipeline
Slate Canyon

Plate

4



* Relative Elevation

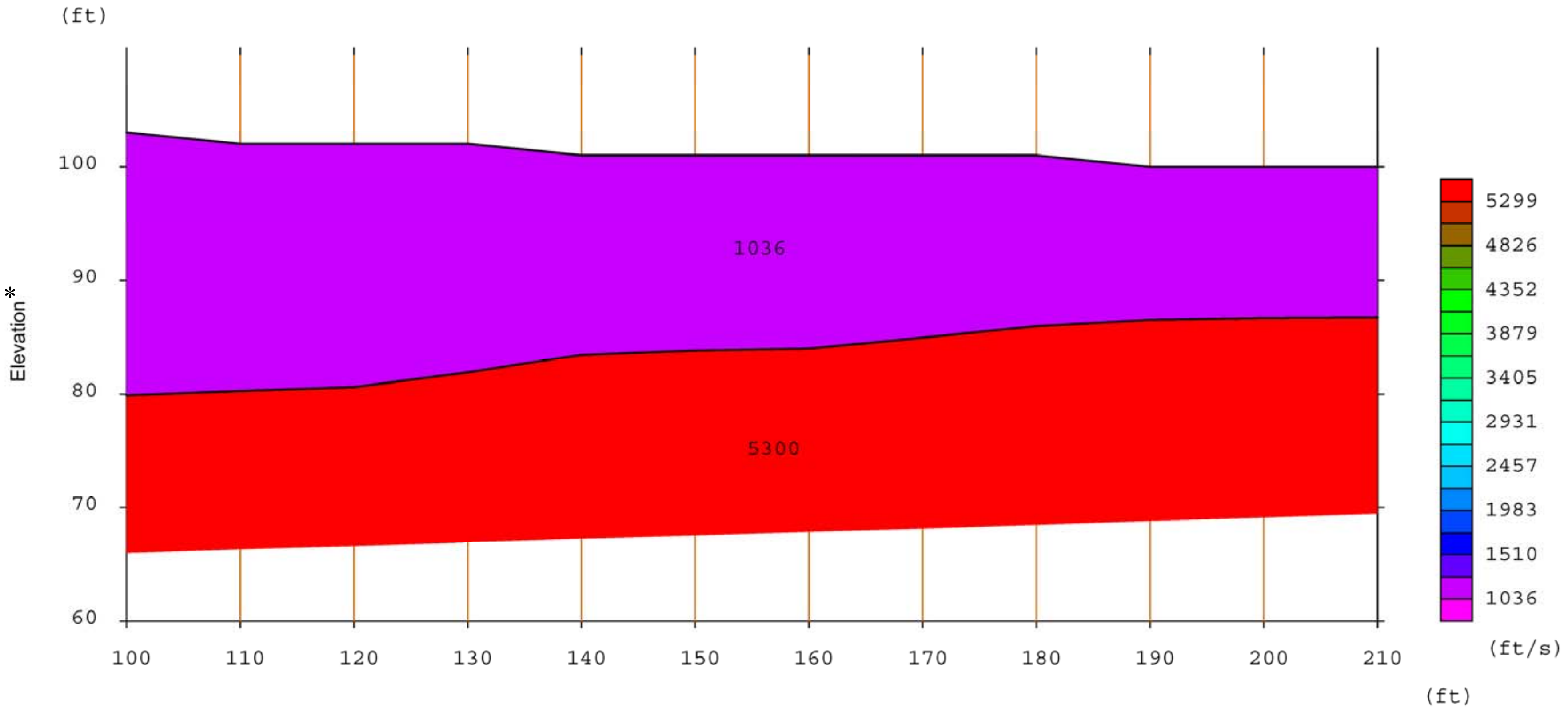
IGES

Line 2 – Deseret Limestone

Geotechnical Assessment
Proposed Pipeline
Slate Canyon
Provo, UT

Plate

5



* Relative Elevation

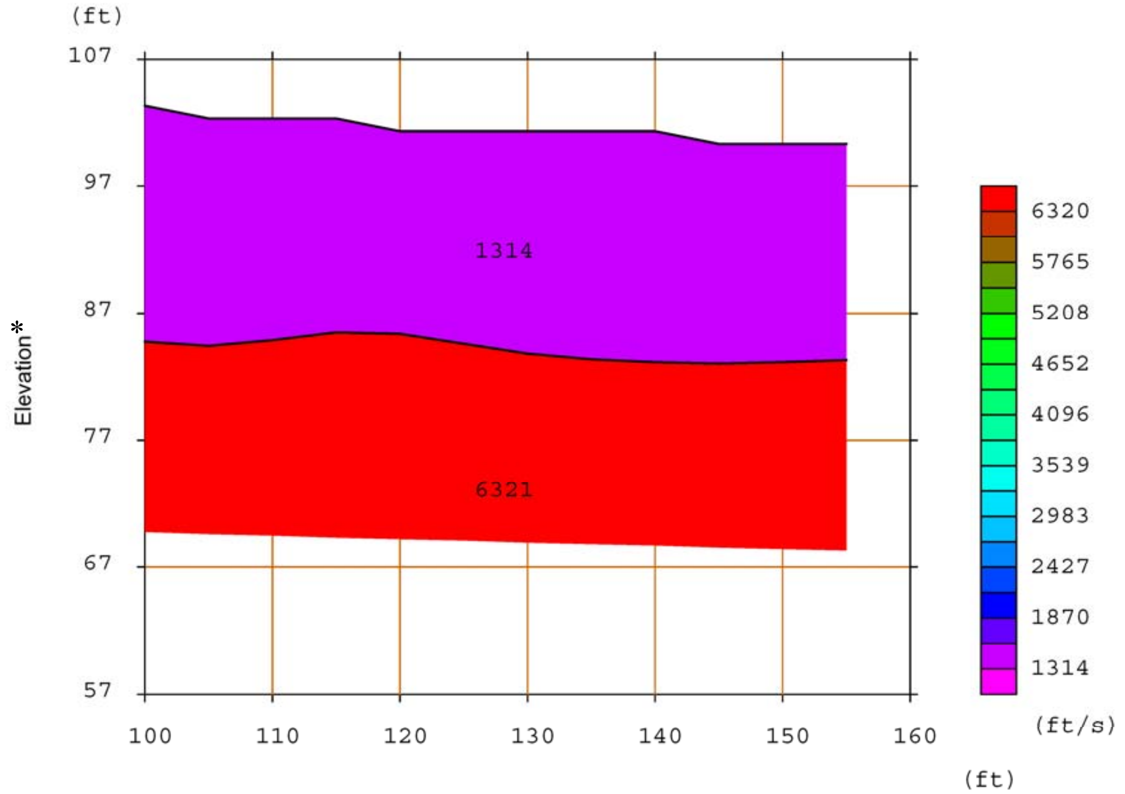
IGES

Line 3 – Gardison Limestone

Geotechnical Assessment
Proposed Pipeline
Slate Canyon

Plate

6



* Relative Elevation

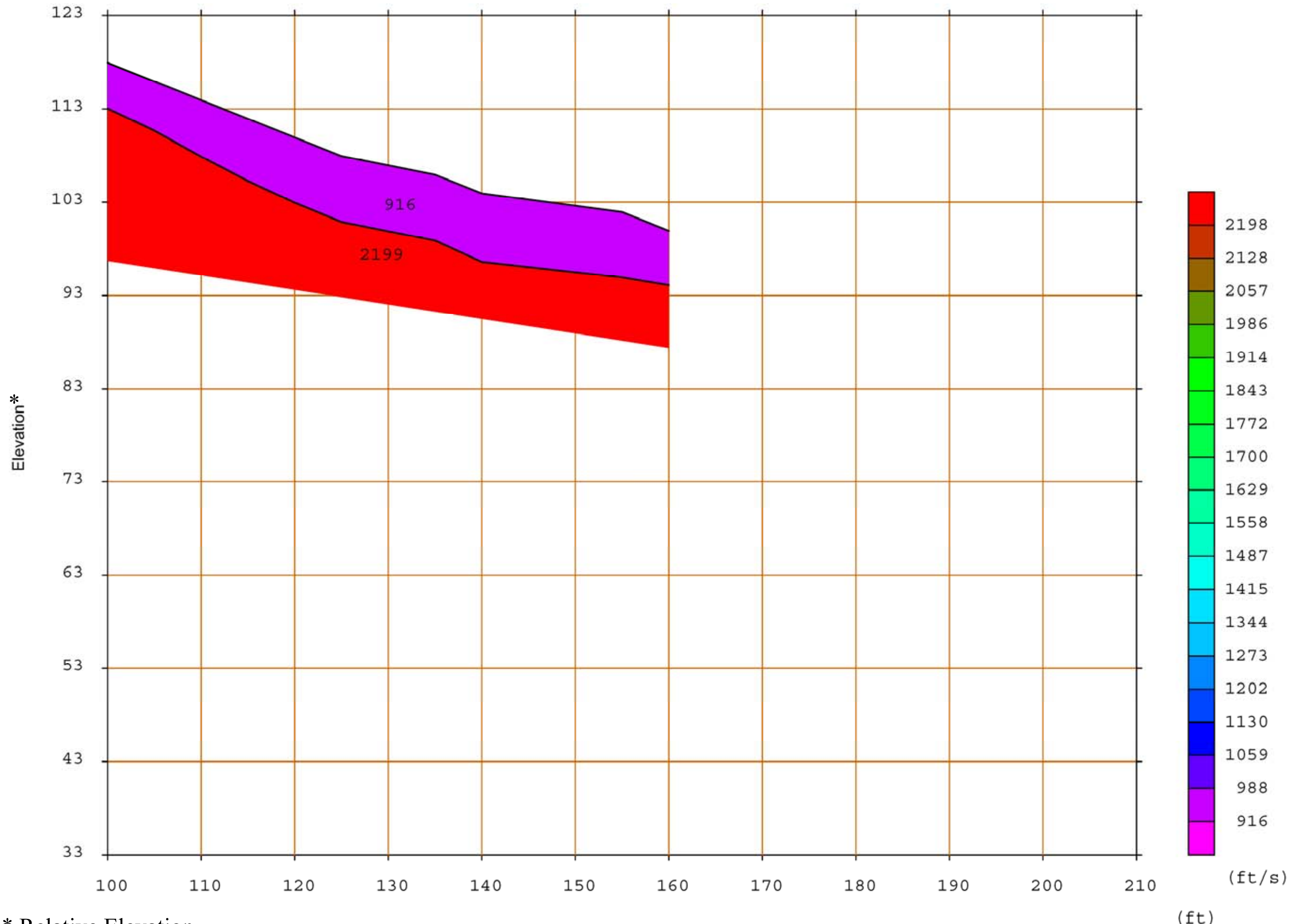
IGES

Line 4 – Fitchville Formation

Geotechnical Assessment
Proposed Pipeline
Slate Canyon

Plate

7



* Relative Elevation

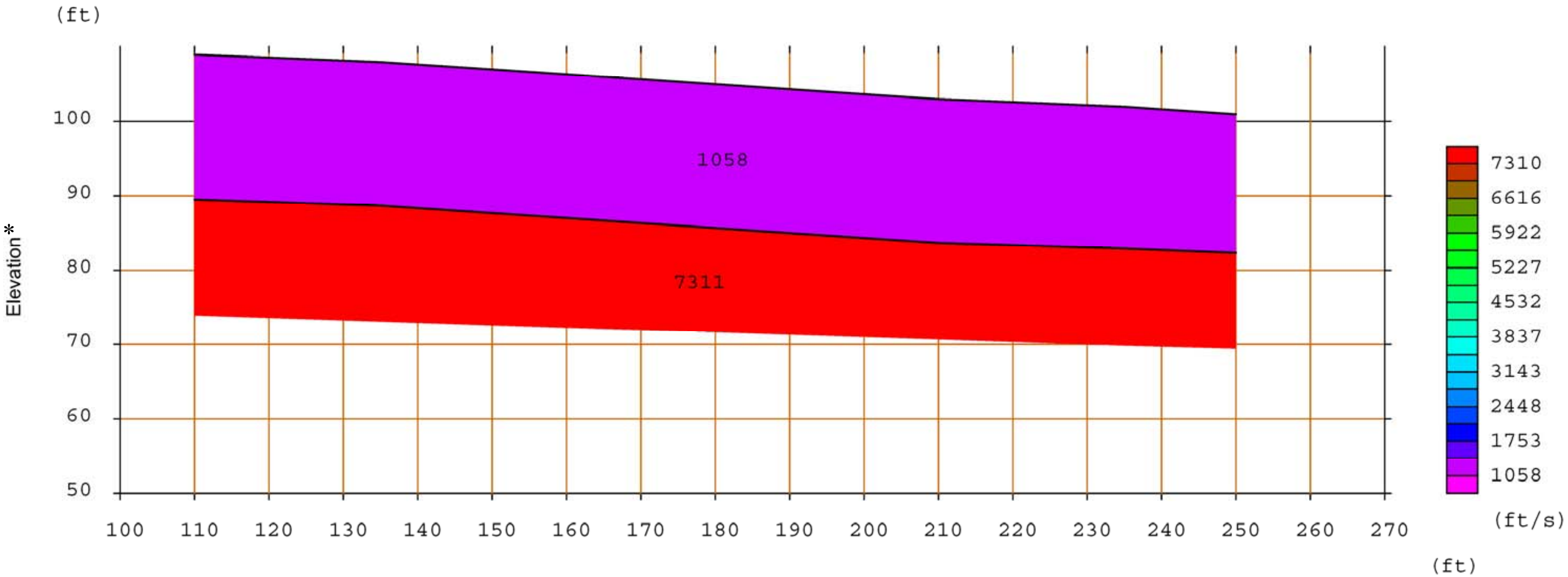
IGES

Line 5 – Maxfield Limestone

Geotechnical Assessment
Proposed Pipeline
Slate Canyon

Plate

8



* Relative Elevation

IGES

Line 6 – Tintic Quartzite

Geotechnical Assessment
Proposed Pipeline
Slate Canyon

Plate

9